

Clone Name: <b>AFRI-DS-1</b>		
Characters	Details	
Species name	<i>Dalbergia sissoo</i> Roxb. ex DC.	
Suitable state/region	Semi-arid and sub- humid tracts of Gujarat (North, middle, upper and southern agro-climatic region of Gujarat) and hot semi-arid upland region of Rajasthan.	
Pedigree/Origin	Uttarakhand	
Mean Annual Yield	<b>12.69 CuM/ha/year</b>	
Disease resistance	Tolerant to major diseases	
Salient features	Straighter bole, higher clear bole height and higher total wood yield.	

Clone Name: <b>AFRI-DS-2</b>		
Characters	Details	
Species name	<i>Dalbergia sissoo</i> Roxb. ex DC.	
Suitable state/region	Semi-arid and sub- humid tracts of Gujarat (North, middle, upper and southern agro-climatic region of Gujarat) and hot semi-arid upland region of Rajasthan.	
Pedigree/Origin	Uttarakhand	
Mean Annual Yield	<b>12.40 CuM/ha/year</b>	
Disease resistance	Tolerant to major diseases	
Salient features	Straighter bole, higher clear bole height and higher total wood yield.	

Clone Name: <b>AFRI-DS-4</b>		
Characters	Details	
Species name	<i>Dalbergia sissoo</i> Roxb. ex DC.	
Suitable state/region	Semi-arid and sub- humid tracts of Gujarat (North, middle, upper and southern agro-climatic region of Gujarat) and hot semi-arid upland region of Rajasthan.	
Pedigree/Origin	Gujarat	
Mean Annual Yield	<b>8.91 CuM/ha/year</b>	
Disease resistance	Tolerant to major diseases	
Salient features	Straighter bole, higher clear bole height and higher total wood yield.	

Suitable agro climatic zones for planting of released clones in Gujarat

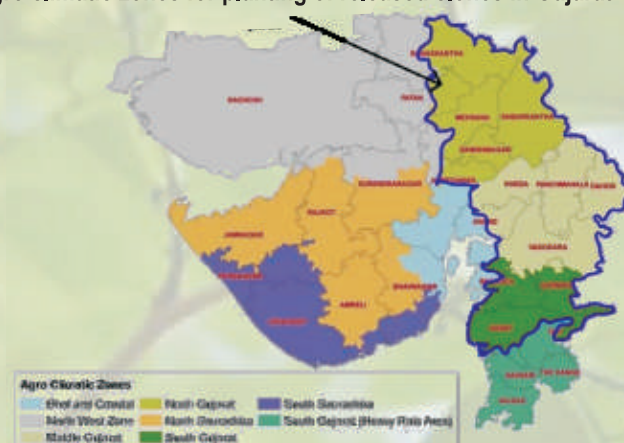


Fig. 3 Suitable agro climatic zones for planting of released clones in Gujarat State



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High Yielding Clones of Shisham  
(*Dalbergia sissoo* Roxb. ex DC.) for Planting in  
Hot Semi Arid and Sub-humid tracts of Gujarat  
and Uplands of Rajasthan



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Introduction

*Dalbergia sissoo* Roxb. ex DC. belongs to the family Fabaceae and commonly known as North Indian Rose Wood in English, and *Shisham*, *Sissoo* or *Tahli* in local languages. It is one of the best timber species of India in terms of market price, quality and durability. It has been planted in many tropical countries worldwide for timber, fuel wood, fodder, shade and stabilization of eroding landscapes. Being a moderately fast-growing multipurpose tree species, it has been widely used in forestry and tree planting programmes throughout India.

The Arid Forest Research Institute (AFRI) Jodhpur first time ever has released three clones of *D. sissoo* suitable for hot semi-arid and sub humid region of Gujarat and uplands of Rajasthan after 30 years of research in tree improvement of this species. These are the first set of clones released for this region, so far. Detailed description and process of development of these clones are described here.

Importance of *D. sissoo* and its uses

*D. sissoo* occurs naturally in riverine ecosystems in India in the foothills of Himalayas and commonly found in alluvial soils adjoining rivers, in association with *Acacia catechu*. Being a leguminous tree, it fixes atmospheric nitrogen and is most preferred plantation species by the villagers. It is mainly grown for the timber which is used for cabinets, furniture and veneer. The sapwood is also used for paper pulp. It is lopped for fodder and small branches are used as fuel wood. However, poor stem form and forked bole are the major drawbacks of this species. Therefore, basic objective of improvement in this species is to improve both growth and tree form.

Jodhpur woodcraft industry provides employment to more than one lakh people living around the city. The annual turnover of this industry is to the extent of Rs. 1500-2000 crores. The handicrafts of Rajasthan are popular throughout the world for their unique quality and exquisite carving. Barmer and Jodhpur districts of Rajasthan are specially known for their wooden handicrafts. The wood products like gift articles, carved items, toys, small utility items and furniture products manufactured here are being exported to all corners of the world through dry port at Jodhpur. Wood of various species are being procured from neighboring states like Punjab, Gujarat, Uttar Pradesh, and Madhya Pradesh, and 'Sheesham Wood' has the major share (about 35%) among all the wood used in the handicrafts. Therefore, apart from State Forest Departments (SFDs) and farmers, the wooden handicraft industry will also be highly benefitted if these high yielding clones are planted in large scale in the region.

Tree Improvement of *D. sissoo* at AFRI, Jodhpur

Since 1990s, ICFRE and its Institutes have undertaken tree improvement programme on *D. sissoo* which mainly consisted of activities like selection of plus trees / superior clones, clonal multiplication, evaluation and establishment of clonal seed orchards. During 1994-2001, ICFRE implemented World Bank assisted 'Forestry Research Education and Extension (FREE)' Project. Under Planting Stock Improvement Programme (PSIP) component of this project, candidate plus tree (CPTs) of *D. sissoo* were selected by various institutes. Arid Forest Research Institute (AFRI) was also involved in Candidate Plus Tree (CPT) selection and establishment of seed orchards. 50 CPTs were identified in best selected stands of *D. sissoo* planted around IGNP areas and in other places throughout Rajasthan following standard methodology. Juvenile branch cuttings were collected from selected CPTs and were rooted under mist chambers.

The rooted plants were planted in AFRI's Vegetative Multiplication Garden

(VMG). Cuttings from CPTs selected in other regions like Uttarakhand and Gujarat were also planted in VMG which had 80 clones in total.

**Establishment of Field Trials:** Four sites namely, Gandhinagar, Deesa, Kheralu and Rajpipla in Gujarat were identified in research centers of Gujarat Forest Department. During 2003, thirty clones were sampled from VMG and planted at a spacing of 4 m x 5 m in replicated clonal trials following a standard statistical field design.

**Assessment of Clonal Trials:** Initially, data were recorded on survival percentage, seedling height and seedling collar diameter. Height and DBH were recorded every year. Final assessment based on basal girth, total height, clear bole height, girth at breast height (GBH) and stem straightness was carried out during January 2021. The data were analysed and clones were ranked based on selection index. After assessing the field performance data, the 'Implementation Team' recommended three top ranking clones namely 103 (AFRI DS-1), 84 (AFRI DS-2) and G5 (AFRI DS-4) for release. These recommended clones were endorsed by the Regional Variety Testing Committee (RVTC) also. Finally, the Variety Release Committee (VRC) of ICFRE in a meeting chaired by DGF & SS, MoEF&CC, GOI, held on 18-11-2021 approved the release the of these three clones for semiarid and subhumid regions of Gujarat.



Fig.1 Locations of clonal trials in Gujarat state

Table 1. Estimated total wood yield and merchantable timber yield from released clones at the age of 18 years (total field trial period).

Clone	Total wood yield		Merchantable timber yield	
	Total Yield (CuM/ha /18 years)	Average Yield (CuM/ha / year )	Total Yield (CuM/ha /18 years )	Average Yield (CuM/ha /Year)
AFRI-DS-1	228.33	12.69	74.00	4.11
AFRI- DS-2	223.25	12.40	55.25	3.07
AFRI-DS-4	160.33	8.91	52.35	2.91

Table 2. Performance statistics of released clones of *D. sissoo* over across site mean and control clone (G8).

Clone	Merchantable Timber Yield CuM / tree		Average Selection Index Score*		
	Superiority over overall mean (%)	Av. Superiority over control (G8) (%)	Av. score	Index	control (G8)
AFRI-DS-1 (103)	70.57	95.87	99.67	-23.3	
AFRI-DS-2 (84)	59.83	121.51	73.00		
AFRI-DS-4 (G5)	25.93	45.85	48.67		

Estimated Monitory Benefits from the Released Clones at 25 Years Rotation

Yield from Improved clones

- Expected yield of total wood from clones: 284.0 CuM/ha
- Merchantable log (timber): 84 CuM/ha
- Approx. Rs. 35000/CuM (current merchantable log price)
- Total income from merchantable logs: Rs. 29.40 lakhs/ha
- Additional income from minor timber & fuelwood : Rs.7.0 lakhs (@Rs. 5 /kg for 140 tons/ha fuelwood)
- Average expected gross income /ha: Rs. 36.40 lakh (Approx.)

Yield from stand average

- Expected yield of total wood from stand average : 147 CuM /ha
- Merchantable log (timber): 58.25 CuM
- Total income from merchantable logs: Rs. 20.38 lakhs/ha
- Additional income from minor timber & fuelwood: 3.5 lakhs/ha
- Average expected gross income /ha/25 years = Rs. 23.88 lakh

Monitory Gain from planting Improved Clones

- Total gain : Rs. 12.52 lakhs/ha (Approx.)
- Mean annual benefit: Rs. 50,000/ha/year

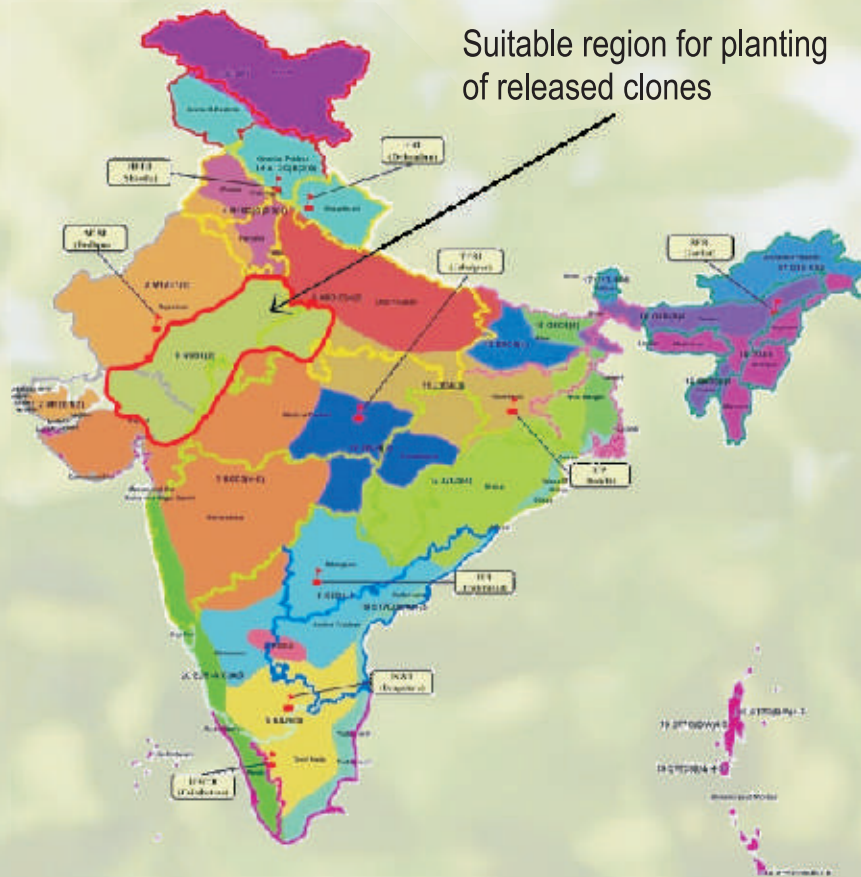


Fig. 2 Suitable region for planting of released clones